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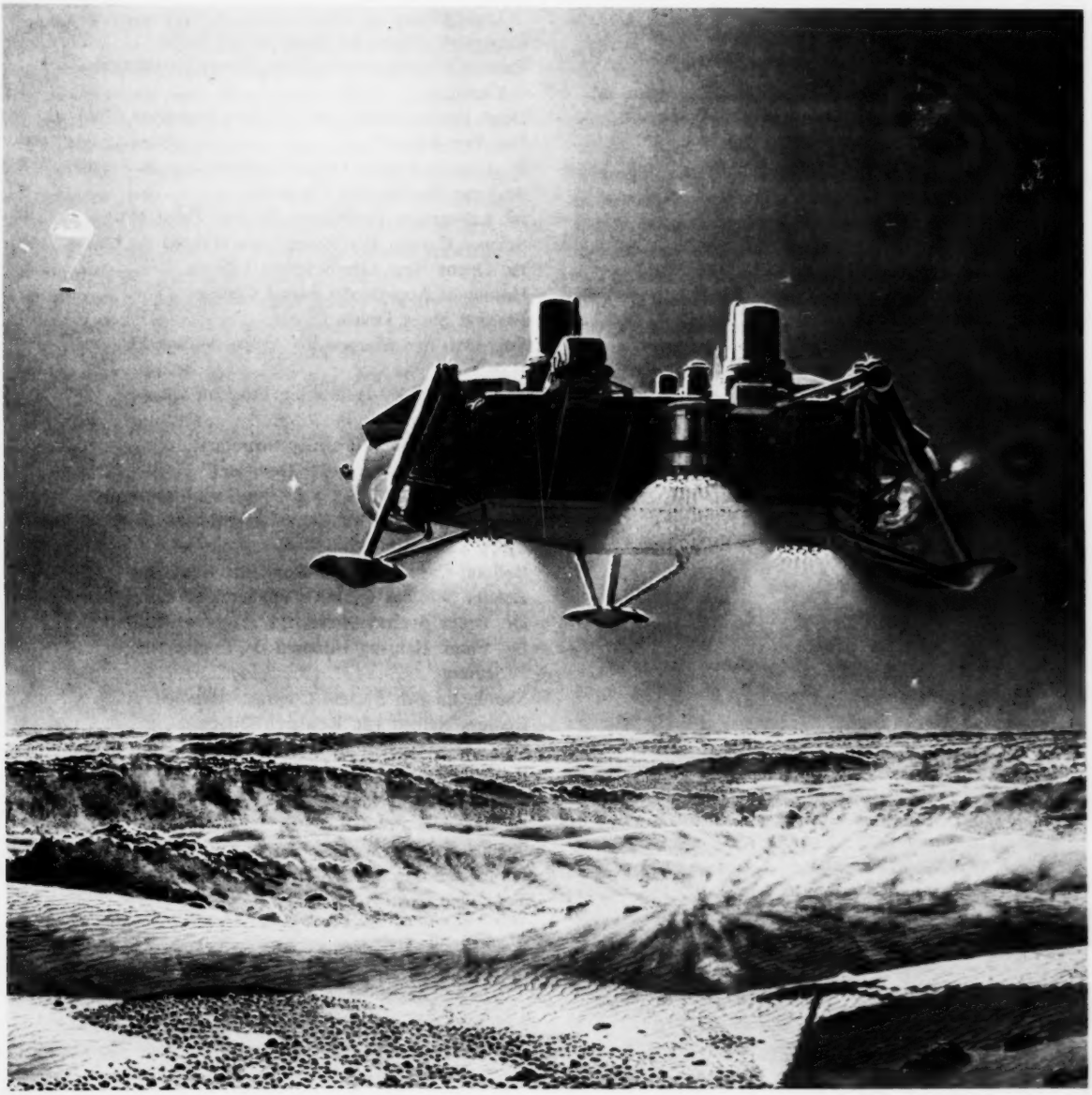

COVER

An artist's drawing of the Viking Mars Lander as it heads for a touch down on the Martian surface at the prime landing site, Chryss, about July 4, 1976, ending a 704-million-kilometer (440-million-mile) journey from Earth scheduled to begin with launch on August 11. The Lander detaches at a distance of about 20,000 feet from the surface.

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Monthly NASA Highlights

Meteorological Satellite Placed in Orbit

Nimbus-F, sixth in the series, was launched successfully from the Western Test Range by a Delta launch vehicle on June 12. The launch vehicle performance was normal and placed the Nimbus observatory into a nearly circular Sun-synchronous orbit. The launch vehicle project is managed for NASA by the Goddard Space Flight Center.

The Nimbus-F Observatory Spacecraft, also managed by Goddard, is part of a meteorological satellite program designed to perform R&D meteorologial and applications observations. It will extend the basic, flight-proven Nimbus systems to further knowledge of atmospheric constituents and phenomena on a global scale.

The Nimbus program provides an opportunity for participation by members of the international scientific community through the selection and support of proposals for space science investigations. The nine experiments carried on the Nimbus-F were selected from proposals by industry, universities, NASA Centers, and other government agencies.

Specialized Solar Observing Platform Launched Successfully

The Orbiting Solar Observatory (OSO-8) was launched successfully from the Eastern Test Range by a NASA Delta launch vehicle on June 21.

The Observatory consists of the supporting spacecraft and eight scientific experiments. The Goddard Space Flight Center has managed the design, construction, and testing of the spacecraft, as well as the integration of the scientific instruments into the observatory.

The scientific instruments were furnished by the University of Colorado, Centre National de la Recherche Scientifique, Columbia University, Lockheed Missiles and Space Co., University of Wisconsin, Naval Research Laboratory, and Goddard.

NASA's Orbiting Solar Observatories provide specialized space observing platforms which return data on the Sun that cannot be obtained by ground-based observation. The OSO-8 spacecraft is designed to obtain new knowledge of the Sun, the Earth's atmosphere and Sun-activated terrestrial phenomena over a broad range of the electromagnetic spectrum. Study of the Sun is important because it is the primary source of energy that supports all life on Earth. The data received will help understand more fully the effect of the Sun on the Earth and its environment.

Solid-State Imaging Camera Under Development

A solid-state planetary imaging camera now being developed at the Jet Propulsion Laboratory uses a charge-coupled device (CCD) semiconductor technology as the sensing element instead of the conventional glass-enclosed vidicon (TV) tube.

The CCD converts incident light into electrons, which are transferred and processed onto a TV screen. Normally, light from a scene is converted by means of a vidicon tube into a picture.

The advantages of the new camera over the Mariner vidicon tube-type camera are a twofold reduction in weight, a fourfold reduction in power consumption, a threefold reduction in parts count, and a twofold increase in sensitivity. In addition, because the CCD sensing array has no cathode, there is no inherent wear-out mechanism, and its reliability and lifetime are greatly improved.

The camera's resolution was increased recently from 100 x 165 elements to 400 x 400 elements. Moreover, it is capable of operating under a wide range of light levels.

This Office of Aeronautical and Space Technology program has applications to Space Shuttle remote sensing spaceborne astronomy, ground astronomy, and celestial navigation.

LeRC Pursues Alternate Fuel Program

The Lewis Research Center recently conducted a brief test of a jet engine combustion chamber using fuel derived from oil-bearing shale rock. Performance was essentially the same as when jet fuel refined from crude petroleum was used.

The NASA alternate fuels program has been underway for about a year and a half under the Aeronautical Propulsion Program of the Office of Aeronautics and Space Technology. It closely supports alternate aviation jet fuels programs of the Navy and Air Force. This fuels program is restricted to research on liquid hydrocarbon fuels.

Two approaches are being taken in the alternate fuels program. One is to exploit the vast domestic reserves of hydrocarbon-bearing substances—specifically coal and shale rock. The other approach is based on determining how tolerant the modern jet engine is to fuels refined to less exacting specifications than is currently the practice.

Preliminary studies indicate that crude oil derived from shale rock may be easier to convert to jet fuel than coal. The highest quality shale rock, also referred to as oil shale, is mainly concentrated in the Utah, Wyoming and

Colorado area. This country's estimated reserves of oil shale amount to more than 1,000 billion barrels. By comparison, Middle East crude petroleum reserves are estimated at about 350 billion barrels.

Because it will be many years—estimates vary—before appreciable quantities of any alternate fuels appear, NASA also is concentrating on research on fuel properties as they affect engine performance.

In the recent past, when jet engine fuel was relatively inexpensive, i.e.: 10 to 12 cents per gallon, the very best quality could be specified. Jet fuel prices are now approaching the 30-cent-per-gallon range. Simplified refining techniques could hold this price increase down. It could also increase the refinery yield available as a jet engine fuel. These two pluses are offset by degraded fuel properties which could adversely affect engine starting, durability, or exhaust missions.

A large portion of the NASA research effort will concentrate on evaluating the effects of lower grade fuels—so-called broad specification fuels—on jet engine performance and durability. Understanding these effects will provide engine manufacturers with a basis for possible modifications to their engines to accept the broad specification fuels.

Active Control Provided for General Aviation

A separated surface control system for general aviation aircraft has been developed and extensively ground-tested by the University of Kansas under the direction of the NASA Flight Research Center. This program was conducted under the Guidance Control Program of the Office of Aeronautics and Space Technology.

The system is presently installed on a Beech 99 airplane. Approximately one-third of each control surface is controlled by an automated avionics system. The pilot controls the remaining two-thirds of the control surfaces. With the avionics in the off condition, the separated surfaces operate independently of the pilot's control surfaces to cause the airplane to assume and maintain the attitude that is commanded from the pilot's control wheel. The pilot's two-thirds control authority allows him to overcontrol the effects of the separate surfaces in the event of system failure.

The first flight with the system operating was scheduled for July 9. The flight test program, including functional tests, envelope expansion, system optimization and a quantitative and qualitative evaluation using three test pilots, will be conducted by Beech Aircraft in Kansas and is expected to be completed by next January.

These flight tests will provide the general aviation industry with a low-cost active control system which will improve the ride quality, reduce pilot workload, and improve safety.

Improved Medical Diagnostic System Developed

A new technique to produce pictures on a cathode-ray tube screen that will display diagnostic information, similarly provided by x-ray to physicians, has been devised by two research scientists at the Jet Propulsion Laboratory. The system using ultrasound (high frequency) sound waves is well above the range of human hearing.

The researchers, Richard Heyser and Dr. Dennis LeCroissette, say the resulting picture looks like an x-ray and presently takes shape in two to four minutes. Bones, muscles, organs, and differences in soft tissues can be seen clearly. The uniqueness of the JPL system is that the sound is emitted in the form of a "chirp." The high frequency waves are varied in pitch so they can be better identified when they reach the receiver.

Differences in frequency response and absorption properties of the various tissues and parts of the body have been demonstrated in laboratory tests using this method. This means that physicians may be able to differentiate between a cyst and a tumor within the body by observing the screen.

The scientists plan to evaluate the system to show its usefulness in hospital applications and attempt as their first goal positive detection and identification of tumors in the female breast. □

ERDA, NASA Sign Energy Agreement

An interagency cooperative agreement to enhance the national energy research and development effort has been signed by the Energy Research and Development Administration (ERDA) and NASA. Under its terms, the management of both agencies will identify specific program tasks which can be undertaken by NASA Centers in support of ERDA activities.

NASA provides an important capability for supporting the national energy R&D program with its engineering and scientific personnel, extensive research facilities, and proven management techniques and procedures.

ERDA will use the NASA capabilities in three broad areas:

- Basic and applied research and technological work will be performed at selected NASA Centers in specified fields such as solar systems, gas turbines, fuel cells, hydrogen technology, ground propulsion technology, bearings, seals, combustion, automatic control systems, materials and structures.
- NASA will be able to submit proposals and plans to ERDA for specific technology developments, including testing, evaluation and demonstration of projects or hardware.
- ERDA may call upon NASA for technical and administrative expertise on both a short- and long-term basis for assistance with ERDA's extensive management arrangements with high-technology institutions in the private sector. These arrangements will include technical

Agreeing on Energy Efforts—*Dr. Robert C. Seamans, Jr. (left), former Deputy NASA Administrator and now Administrator of the Energy Research and Development Administration, signs an agreement to strengthen the national energy program through interagency cooperation while present NASA Administrator James C. Fletcher looks on.*

review boards, evaluation groups and other assessment techniques.

Most program and project activities undertaken by NASA for ERDA under the agreement will involve contractual arrangements with non-governmental institutions. Such arrangements will be conducted under NASA policy, regulations and procedures, except when in conflict with ERDA statutory requirements.

An ERDA-NASA Program Coordination Committee will be formed to provide a continuing mechanism for reviewing the scope of NASA support for ERDA programs. It will meet quarterly.

This committee also will conduct a joint review each year of NASA R&D work in support of ERDA, preceding submission of the ERDA program recommendations to the Office of Management and Budget and to the President.

Scientists Discuss Cities in Space

The problems man may face if he should ever want or need to leave Earth are now undergoing study. During June, university and government scientists gathered at Ames Research Center to open a 10-week workshop on the subject of space colonization.

Sponsored by ARC and Stanford University, the studies are concentrating on reducing theory to engineering, social and economic considerations to see what really would be needed to send human colonies to new homes in space. Among ideas to be weighed are the creation of an artificial planetoid and the use of the planet Mars as places where mankind could emigrate.

The problems in such an endeavor are staggering, but they may be within the grasp of current technology, according to Dr. Richard D. Johnson of NASA and Prof. William Verplank of Stanford University.

The orbiting community concept, like the space habitat proposed by Dr. Gerard K. O'Neill of Princeton University, who is aiding in the study, proposes to use lunar or asteroidal raw materials in the construction of an artificial planetoid. The study will concentrate on how to utilize extraterrestrial materials, how to process them, and how to transport them to the "construction site" in space.

One aspect of the planetoid as suggested by O'Neill is to use it as a construction site for a collector of solar energy. Solar radiation would be converted to electricity and beamed by microwave to Earth. Such a source of energy for man's future needs would avoid the problems of conventional energy sources such as coal, petroleum and nuclear reactors

A separate study headed by Dr. Robert MacElroy of Ames will take a new scientific look at Mars. The Red Planet, more like Earth than any other, could be a target for human migration. The idea is to build a breathable atmosphere in what is now an alien environment. It might be done in a matter of decades, theorists say, if conditions could be created where algae-like organisms could use solar energy and photosynthesis to make oxygen, just as green plants do on Earth. These conditions may be possible if a way is found to irrigate Mars with water suspected to be in or under its soil.

HEAO-Type Star Trackers Working Well

Two star-tracker instruments identical to the ones scheduled for use in the High Energy Astronomy Observatory (HEAO) managed by the Marshall Space Flight Center are reported functioning well as part of a recently-launched Small Astronomy Satellite (SAS-C).

The star-trackers are optical electronic devices which lock onto a star and track it to determine its relation to a coordinate system. The information from the star-trackers is used to establish the location and attitude of the observatory in space.

Two of the star-trackers will be carried aboard HEAO-A, the first of three unmanned scientific observatories set for launch into low Earth orbit between 1977 and 1979 to study some of the most intriguing mysteries of the universe—pulsars, black holes, neutron stars, and supernovae.

Earth Resources Survey Symposium Draws Hundreds

More than 1,300 scientists, engineers, resource managers in government and industry, teachers, state governors, legislators, and private and public administrators from all over the United States and 30 foreign countries attended an Earth Resources Survey Symposium sponsored by NASA's Office of Applications and the Johnson Space Center at Houston, TX, June 9-12.

Keynote speaker at the opening session was Dr. Wernher von Braun, Vice President of Fairchild Industries, former Director of the Marshall Space Flight

Center and former NASA Deputy Associate Administrator. Caspar W. Weinberger, Secretary of Health, Education and Welfare, delivered the major address on the final day of the symposium.

Practical uses of remote sensing from spacecraft and aircraft to help solve local, regional, national, and global environmental and critical natural resource problems were covered in more than 150 reports presented during the four-day meeting.

Primary focus of the symposium was on practical applications of Earth resources survey data gathered by LANDSAT-1 and LANDSAT-2 spacecraft, the Earth Resources experiment Package carried in the Skylab manned experimental space station, and Earth Resources Survey aircraft. The purpose was to bring together those who have developed the technology for remote sensing of Earth's resources and those who are using this information or could use it.

General sessions were held on the following subjects:

Agriculture, forestry, range resource inventory and management; geological structure, landform surveys, energy and extractive resources; environmental surveys and applications; water resources management; land use and regional planning; marine resources, coastal zone management, and ocean surveys; information systems and services.

Special sessions, including panel discussions and audience interaction, concerned state and local applications of remotely sensed data, coastal zone management, and user services.

Science Careers for Women Encouraged at Lewis

The idea that women can find useful and worthwhile careers in science recently received definite encouragement at the Lewis Research Center. Its endorsement came over a 10-week period during which approximately 250 Cadette and Senior Girl Scouts between the ages of 11 and 17 were welcomed there and conducted on tours of laboratories and other facilities.

Seventeen of LeRC's women employees took active roles in the program, each striving in her own way to impress upon the visiting girls the importance of the field of science and the opportunities which it may hold out to them.

"Our primary objective in bringing the girls to Lewis," explains Patricia J. Smith, a mathematician-programmer, a Cadette leader herself, and the one who issued the invitations to tour the Center, "was to have them visit with women scientists and technicians. This would enable them to see that women actually do work in these fields.

"At the same time, the women have an opportunity to explain what they do, so that the girls can gain an idea of what to expect if they decide to enter a scientific field. We also hoped to encourage them to take math and other science courses in high school, because it is difficult to catch up in college if they decide later they want a scientific career."

Leading Girls to Science—*Marilyn Weaver welcomes a group of Cadettes to Lewis Research Center. Seated beside her and facing the visitors are, left to right, Sylvia Taylor, Sue Beatty and Genevieve Esgar.*

Genevieve Esgar, one of the engineers who took part in the program, explains the effort this way: "Who has successfully baked a cake from scratch, or taken a toy apart to see how it works, then put it together again? This is basically what chemists and engineers are doing, only they are working with different ingredients."

The women escorted the girls about laboratories, explaining the various facilities and their functions and describing work situations. Each tour took in an engineering or compressor lab, a chemistry lab, one of the wind tunnels, and a science-related panel discussion.

In addition to Ms. Smith and Ms. Esgar, the following women participated:

Evelyn Anagnostou, chemist; Sue Beatty, librarian; Peggy Evanich, engineer; Eileen Gorrell, mathematician; Lee Jarobek, librarian; Evao Luedecke, physician science technician; Sue Modarelli, receptionist; Dorothy Morris, Library Branch head; Pat O'Donnell, chemist; Joan Oravex, mathematician; Loretta Shaw, engineer; Sylvia Taylor, editor; Carol Vidoli, editor; Marilyn Weaver, editor; and Del Zatroch, secretary.

JSC Opens New Life Sciences Library

Information on how man responds to space flight has been collected and catalogued in the Space Life Sciences Archival Library, opened at Johnson Space Center June 2.

Housed in what was formerly the Apollo Lunar Receiving Laboratory, it contains data on biomedical experiments, investigations and hardware gathered in manned space flight programs.

"Although this central repository will ultimately contain information from earlier and future manned space and associated life sciences endeavors," announced JSC Life Sciences Director Richard S. Johnston, "the archives presently consist of a comprehensive compilaton of data obtained during the Skylab program—our most recent and extensive manned space flight experience."

The medical information stored in the library is retrieved for the reader and viewer through a computerized system with video, microfilm and computer terminal readers and printers.

Study Seeks Quieter, Cleaner Engines for Light Planes

Quieter, cleaner engines for light airplanes are the goal of a study now in progress at Lewis Research Center. Such research in the past has been limited to larger, commerical aircraft.

Under a program known as Quiet Clean General Aviation Turbofan (QCGAT), experiments center around a general aviation turbojet or turbofan engine core. It will incorporate the latest technology derived from NASA's Quiet Engine and Experimental Clean Combustor Programs, as well as other related technology studies.

The objective is an improved engine for general aviation airplanes that is practical and which can also meet the price and production requirements of the general aviation market.

Ganymede Found to Have Rough Surface

Jupiter's largest moon, Ganymede, has been probed by radar for the first time and found to have a surface considerably rougher than those of Mercury, Mars and Venus.

This is the report of Dr. Richard M. Goldstein, Manager of the Jet Propulsion Laboratory's Communications Research Section, and a co-investigator, George A. Morris, recently published in the journal *Science*. They conducted tests on six nights during a one-week period last August, directing a 400-kilowatt beam of microwaves at the distant moon, which rotates around Jupiter every 7.15 days.

"Perhaps the most likely possibility for the surface of Ganymede is rocky and/or metallic material imbedded in a matrix of ice," they reported. "Such a surface could be relatively smooth, with a top layer of ice rubble, but it would be rough to radar since the ice would be transparent."

The finding is considered particularly interesting in view of verification by Pioneer 10 and 11 flybys that Jupiter itself is gaseous, with no solid surface that could sustain a radar echo. Goldstein theorizes that the material on Ganymede probably is meteoritic in origin. However craggy it may be, the radar was unable to delineate craters because of the extreme distance, he said.

The radar astronomers found "a simple sphere of ice does not fit well with the radar data." A hard rocky surface coated by frost or light ice could be possible, they agreed, but they think the mixed rock-metal and the ice surface more likely.

Pioneer 10 Experiences Unexplained Orientation Changes

The Pioneer 10 spacecraft, now halfway between the orbits of Jupiter and Saturn on its way out of the solar system, is making some small, unexplained orientation changes, it is reported from Ames Research Center.

The spacecraft's axis of rotation is changing position one twelfth of a degree per day, or roughly one degree every two weeks, in the same direction. Project officials say they do not know the reason for these changes, that they could be due either to a very slight malfunction or to some kind of interplanetary phenomenon. Evidence so far is contradictory.

If the spacecraft, which rotates at five revolutions per minute, is moving from the force of a tiny gas leak in its attitude control system, then these tiny thrusts would have to be timed exactly—five times a minute—an unlikely condition. Magnetic field effects either from space or on board the spacecraft have been largely ruled out. If Pioneer is encountering interplanetary dust between Jupiter and Saturn, radio tracking should show small changes in spacecraft speed, and speed changes have not been noted.

In mid-June, attitude changes at the present rate had been taking place for three weeks, with small changes before that. Additional tests are planned to find their cause.

Hugh Harris Named KSC Public Information Chief

Hugh Harris tool over his new duties in July, at Lewis Research Center, has been appointed to a similar capacity at Kennedy Space Center, succeeding Charles T. Hollinshead, recently named Chief of Public Affairs following the retirement of Gordon L. Harris.

Hugh Harris took over his new duties in July, assuming a role with which he is familiar. As part of his work at LeRC, where he has been employed since 1963, he has helped with Public Affairs activities in connection with more than 40 launches of Atlas-Agena, Thor-Agena, Atlas-Centaur and Titan-Centaur rockets. He also assisted with such activities at KSC and the Johnson Space Center on Apollo lunar missions.

A native of Cleveland, he was employed prior to joining NASA as a writer for several newspapers, a radio station and a magazine.

Did You Know?

Materials with permanent magnetism characteristics will be melted and recast as solids during the Apollo Soyuz Test Project mission to determine whether such processing in space will improve their magnetic properties.

In addition, astronauts will attempt to "manufacture" a space-made material which could improve communications on Earth considerably through better electronic circuitry, telephone and television equipment. Elements will be combined in a small electric furnace to produce optical fibers, embedded in a matrix, with qualities which cannot be duplicated in an Earthbound laboratory. The furnace is being developed by the Marshall Space Flight Center.

Guided tours at the nation's Spaceport during May exceeded those for the same month last year by 37.7 percent, while the cumulative total for 1975—489,163—is 66 percent higher than that for the first five months of 1974.

The Johnson Space Center and Local 2284 of the American Federation of Government Employees (AFGE) have signed a contract covering personnel practices and working conditions of most federal employees at the Center. It becomes effective following review at NASA Headquarters.

The Marshall Space Flight Center is hiring a total of 256 summer employees under the Summer Student Employment Program. They will be placed throughout the Center in every organizational segment. MSFC also has been authorized 10 excepted appointments for employing summer interns, high school and college faculty.

Western Union Telegraph Co., Upper Saddle River, NJ, and RCA Global Communications, Inc., New York, NY, have been selected for negotiations leading to Phase I contract awards to provide a detailed system design proposal of a Tracking and Data Relay Satellite System (TDRSS) to be developed and operated by industry to meet NASA service requirements.

The Mayfair Construction Co. of Chicago is the apparent low bidder on a contract to modify the Vehicle Assembly Building for Space Shuttle operations at the Kennedy Space Center. Its bid was $5,137,827, under the next lowest bid by $2,000.

The first of the two Viking spacecraft to be launched toward Mars in August has successfully completed sterilization at the Kennedy Space Center. It survived a temperature of 112 degrees Centigrade (233 degrees Fahrenheit).

The Marshall Space Flight Center has established a Solar Heating and Cooling Task Team to attend to tasks assigned by the Energy Research and Development Administration.

Generation of laser light directly from nuclear energy has been achieved recently by several research groups in the U.S. Scientists see it as a step toward a source of almost unlimited energy that can be turned on at will to beam enormous power over large distances on Earth and in space.

Is the Moon a piece of Earth that broke away early in the Earth's formation about four and a half billion years ago? A paper presented before the Royal Society in London, England, in June suggests that this fission theory should be seriously considered. It was prepared by Dr. John A. O'Keefe of Goddard Space Flight Center and Nobel prize winner Prof. Harold C. Urey of the University of California.

Wackenhut Services, Inc., Coral Gables, FL, has been awarded a cost-plus-fixed-fee/award fee contract to continue protective support services at the Johnson Space Center. The contract has an estimated cost (including fee) of approximately $1.6 million and is for services through June 30, 1976. □

First Space Shuttle Engine Ignition Test Is Success

The first in a series of ignition tests of a Space Shuttle Main Engine has been conducted successfully.

Quick-look evaluation of data from the brief test indicated that all test parameters were satisfactory and the test objective achieved.

Tests are being conducted for the Marshall Space Flight Center by personnel of the Rocketdyne Division of Rockwell International Corp., developer of the engine, using former Saturn facilities at the National Space Technology Laboratory.

The recent test is the first of a series of eight ignition tests which will lead up to the mainstage firing of the main engine later this summer. All ignition tests will be of short duration, with none reaching full engine thrust.

Andrews to Succeed Clements

Edward P. Andrews

Edward P. Andrews, Director of Systems Operation for the Shuttle Program, has been appointed Executive Officer in the Office of the Administrator at NASA Headquarters to succeed Henry E. Clements, who has been reassigned to the Data Systems and Analysis Directorate at the Johnson Space Center, effective the latter part of July.

For the last three years, Andrews, a West Point graduate, has been responsible for the overall planning and utilization of the Space Shuttle as an operational vehicle and has been the primary contact on all facility requirements of the Space Shuttle Office.

Detailed to NASA as an Army major in 1962, he served in succession as Acting Chief, Special Engineering Studies for Manned Space Flight, and as Chief, Lunary Exploration Systems. He resigned his commission in 1964 to accept a position in the newly-established Apollo Applications Program, serving from 1965 to 1969 as Payload Integration Manager. He then was named Manager, Skylab Spacecraft, to oversee the development, test, checkout and evaluation of the Command and Service Modules being modified for Skylab. In 1971, he was assigned to the Shuttle Program.

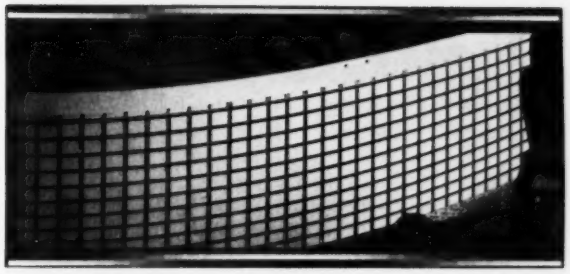
JPL Laboratory to Process Pictures from Mars

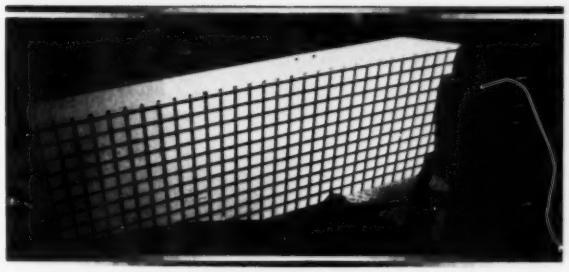
When photo images are returned to Earth in July, 1976, from the Viking Orbiter and Lander, scheduled to be launched on the way to Mars during August, they will be processed at the Jet Propulsion Laboratory's Image Processing Laboratory (IPL).

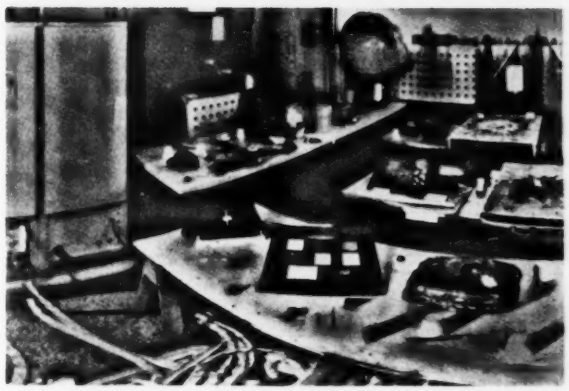
Images recorded by the two cameras on the Lander will exhibit distortion of objects close to the spacecraft. This is due to the techniques used in scanning the scene by the facsimile cameras. IPL is developing a computer program designed to remove the distortion and present the scene as it would appear to an observer located at the Lander camera position.

Special digital computer techniques will include a program that will display the images for stereo viewing which will be used to evaluate the terrain near the landing site. It will also provide maximum discriminability processing of images acquired by the Orbiter cameras during the critical site certification periods prior to Lander separation.

The four photos shown here represent distortion removal from the Viking Lander images taken during pre-flight camera calibration and testing. One is an image of a picture of a grid target used in determining the geometric performance of the cameras. The lines ruled on the target







A Special Photo Processing Technique *has been perfected at the Jet Propulsion Laboratory to improve images taken by the Viking spacecraft cameras. Shown here are two sets of pictures illustrating the rectification it makes possible.*

are perfectly straight, but they become curved and distorted when the camera records the scene. The second picture shows the results after a new computer program has been applied. The geometric distortion has been removed.

The third and fourth pictures are a before-and-after example of rectification of an image of a series of tables containing test charts and various geological samples. The curvature of the table edges has been removed.

Two Viking spacecraft, each consisting of a Lander and Orbiter, will be launched in August, 10 days apart.

Each Orbiter will carry two vidicon cameras that will obtain pictures with a resolution of about 39 m (130 feet) per television line at an altitude of 1,500 M (930 miles). It can distinguish objects about the size of a football field and will aid in confirmation of the preselected landing sites.

The two facsimile cameras on the Lander can be directed to look down at the nearby surface, or perform a 360-degree panoramic scan of the entire landscape.

The cameras will take pictures in black and white and color. These pictures can also be combined to form stereoscopic views of the areas.

Hosenball Appointed General Counsel

S. Neil Hosenball

S. Neil Hosenball, Deputy General Counsel of NASA since 1967, has been appointed General Counsel of the agency, a post in which he has been serving on an acting basis since the transfer in February of R. Tenney Johnson to the Energy Research and Development Administration.

Before becoming Deputy General Counsel, Hosenball was Assistant General Counsel for Procurement Matters. Prior to that, he served for four years at the Lewis Research Center as a Chief Counsel. Earlier, he was with the Cleveland Ordnance District, after nine years of private practice in Cleveland.

A graduate of the Harvard Law School, he currently is a member of the Administrative Conference of the United States and of the U.S. delegation to the Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space. He was awarded NASA's Exceptional Service Medal in 1967 and its Distinguished Service Medal in 1973.

Fashion Show Draws Crowd

The Headquarters NASA Bicentennial Observance Committee staged a "Spring Showboat of Fashion" show on June 5 that attracted a standing-room-only audience.

The 18 women and 14 men models, representing 13 of 21 major offices, showed attire that ranged from bikinis to "after-five" formal dress wear in the first fashion show in NASA Headquarters history.

Fashion Show Planning Committee—*Seated left to right are Mildred Lee, Pat Rich, Commentator Dema Nappier, Alcine Price and Jackie Evans. Its Chairman, Wilson James, and Sue Webster are not shown.*

Earl L. Ginyard, Headquarters EEO Officer, said the performance was highlighted by the smooth, professional manner of the commentator, Dema Nappier.

He also attributed the success of the show, sponsored by the Headquarters EEO Office, to the cooperation of NASA employees and the planning committee, which included Wilson James, Chairman, Jackie Evans, Pat Rich, Alcine Price, Sue Webster and Mildred Lee. The committee is now planning a series of additional events aimed at bringing Headquarters employees closer together.

Space-Air-Sea Mission to Assess Marine Features of Gulf

Data Will be Used to Balance Oceanic Resources and Increase Fish Production

Fishing vessels, research ships, airplanes, oil platforms and space satellites are to be combined in a giant cooperative effort to assess the marine environment of the Gulf of Mexico.

The aim will be to study extensively from every available platform—from the orbit of the spacecraft to the depth of the water—the conditions which may have long-range influence on the living marine resources in the Gulf.

Results of this and other studies will be used in the formation of plans and policies designed to maintain oceanic resources in healthy balance, while continuing to produce a high yield of fishery products from Gulf waters. An effort also will be made to determine whether remote sensing via satellite can be of assistance in managing and harvesting fish.

The mission is sponsored jointly by NASA and the Commerce Department's National Oceanic and Atmospheric Administration (NOAA). In conducting it over a period of 18 months, they will bring together as participants a commercial fishing fleet of some 70 vessels,

three oceanographic research ships, a low-flying "spotter" band of nearly 40 aircraft, several medium-altitude planes, four marine oil platforms, two LANDSAT satellites and a weather satellite.

An attempt will be made to relate coastal environmental conditions to the availability and distribution of two commerically important fish—menhaden and thread herring, both of which occur in large quantities from May through September. They school at or near the surface and thus facilitate detection by remote sensors.

The operational base for the experiment will be NASA's National Space Technology Laboratories (NSTL) at Bay St. Louis, MS, where federal and state cooperating agencies are located. The installation provides computer, laboratory, logistics and technical services. Goddard Space Flight Center, which operates the LANDSAT spacecraft and processes the data, will serve in a supporting role.

Summer Faculty Fellowship Program Opens at MSFC

A total of 44 educators from 37 colleges and universities are participating in the NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Programs this summer at the Marshall Space Flight Center.

The two programs, Engineering Systems Design and Aeronautics and Space Research, are being conducted by Auburn University and the University of Alabama, respectively.

This is the eighth year MSFC has conducted the Engineering Systems Design Program and the 11th year it has conducted the Aeronautics and Space Research Program.

Faculty members of the Engineering Systems Design Program, which runs from June 2 through August 15, will show how energy conservation can be achieved through the application of NASA technology.

Educators in the Aeronautics and Space Program, which opened June 2 and will end August 8, will conduct research in the design and development of space transportation systems, scientific payloads and a wide range of projects in the engineering and natural sciences.

MSFC Holds AMPS Briefing

A briefing for industry on the Atmospheric, Magnetospheric and Plasmas in Space (AMPS) project was conducted recently at the Marshall Space Flight Center.

Requests for proposals for definition of the AMPS payload are to be issued by the Center in the near future, and the briefing was designed to pass on to industry as much information as possible on the AMPS payload, as well as to orient industry on the program's purpose and scope.

The AMPS is to be a manned scientific space laboratory for studying the near-space environment of Earth and how changes in incident solar energy and emission from Earth affect it.

USA

USSR

New Apollo Soyuz Stamps—*The U.S. Postal Service during June released these designs of two commemorative stamps commemorating the Apollo Soyuz space mission. The stamps are scheduled for issue on the day of the twin launches, July 15. For comparison purposes, shown here are photographs of both the U.S. and Soviet designs. However, the Soviet stamps are being released by the Soviet Union and will not be available through U.S. Postal Service facilities. The top stamp, showing the spacecraft in docked position, is the U.S. design, while the bottom stamp, showing the spacecraft separated, is the Soviet design.*

MSFC Biologist Is Former Secretary

Frances E. Scott

A former secretary is now a biologist in the Biotechnology Branch of Materials and Processes Laboratory at the Marshall Space Flight Center and is its investigator for the red blood cell portion of the Electrophoresis experiment to be conducted during the Apollo Soyuz Test Project (ASTP) mission.

She is Miss Frances E. Scott, who, while working as a secretary in the scientific field, attended Athens College, Athens, AL, and received a Bachelor of Science degree in biology. She later attended the University of Alabama at Huntsville, majoring in microbiology.

Prior to her present assignment, Miss Scott worked in sterilization methods for planetary quarantine. She was one of 50 young scientists chosen to attend a three-week seminar at Wallops Island where she helped plan, execute and evaluate the launch of small animals in Arcus rockets.

At present, she is gathering and working with red blood cells to design biological models for the Electrophoresis experiment. These model cells will be used as equipment standards and will predict orbital performance of the experiment with live cells on the ASTP mission. She is also coordinator for the kidney cell and lymphocyte portions of the experiment.

New Information Facility Dedicated

NASA's new and expanded outlet for the technology resulting from its activities, the Scientific and Technical Information Facility (STIF), was formally dedicated on June 20 at Linthicum Heights, MD, near the Baltimore-Washington International Airport.

The dedicatory address was made by Dr. James C. Fletcher, NASA Administrator. A delegation of congressional, state and local officials was on hand for the occasion.

STIF first began operation in 1962 at Bethesda, MD. Its purpose was to play a key role in the transfer of space-developed technology to down-to-earth users, in line with the mandate laid down for the agency by the Space Act of 1958.

As data poured in over the years, the facility was expanded and new and additional equipment, including the latest model computers, was installed. Its information bank now contains well over 1.2 million documents, and is growing at the rate of 80,000 per year, making it the largest and most comprehensive technical data resource in the world. This material has been summarized, indexed, and stored in a manner that allows the retrieval by individuals of the particular parts most likely to help solve their particular problems.

The primary purpose of the massive collection is to keep aerospace scientists and engineers abreast of significant

World's Largest Space Data Bank—*Dr. James C. Fletcher, NASA Administrator, is shown as he dedicated the agency's new Scientific and Technical Information Facility. Below is pictured one of the batteries of computers used in making the data available to the public.*

activities and developments in their specialized fields. The new facility provides a one-floor working environment considered an excellent match with functional needs. In addition to office space, the building includes a well-equipped microphoto publication area, ample storage for classified and unclassified documents, and an efficient computer complex with more than 3.6 bytes of on-line high-speed storage.

Balloon Carries Gamma-Ray Detectors

A giant balloon carrying a gamma-ray detector instrument package for the Marshall Space Flight Center was launched recently from Palestine, TX. It reached an altitude of 40 kilometers (125,000 feet) and took its detection instruments—which were developed and constructed at MSFC—above most of the Earth's atmosphere.

Purpose of the flight was to detect the source and determine the nature of sudden bursts of gamma rays—high-energy bundles of electro-magnetic radiation. These mysterious increases in gamma rays, coming from various directions in space, last from one to 30 seconds.

The balloon's instrument payload was brought to Earth by parachutes, which separated from the balloon upon electronic command from the ground. The payload was recovered undamaged and returned to MSFC for analysis.

Bendix Selected for IEA Contract

The Marshall Space Flight Center has selected Bendix Corporation's Guidance Systems Division for negotiations leading to a contract for Integrated Electronic Assemblies (IEA) for the Solid Rocket Booster of the Space Shuttle.

The resulting contract will be for the design, development, test and evaluation and for fabrication and assembly of IEAs and associated test equipment for the first six Shuttle flights.

The initial contract will call for 33 units, which includes flight articles, spares and development and test versions. The contract will be a cost-plus-incentive-fee/award-fee type agreement.

Dr. Bruce Murray Heads JPL

Dr. Bruce C. Murray

Dr. Bruce C. Murray, widely known planetary scientist and authority on Mars, Mercury and Venus, has been appointed Director of the Jet Propulsion Laboratory (JPL) to succeed Dr. William H. Pickering, who is retiring after 21 years in that position.

The appointment will become effective after the first of the year. JPL is operated for NASA by Caltech.

Commenting on the appointment, Dr. James C. Fletcher, NASA Administrator, said: "Under Dr. Pickering, JPL has dramatically advanced the frontiers of knowledge in space and paved the way for countless future achievements and applications. America and the world are deeply indebted to him.

"The Space program, therefore, is fortunate that the ranks of Caltech are able to supply a replacement with Dr. Murray's outstanding qualifications to assure continuity and further impetus to the vital work lying ahead."

Caltech professor of planetary science and a geologist by training, Dr. Murray has been a researcher with JPL space missions for more than 10 years and with planetary science at Caltech for 15 years. He is the author or co-author of three books and more than 60 scientific papers. A native of New York City, he received his Bachelor's, Master's and Doctoral degrees from the Massachusetts Institute of Techology.

Dr. Frank Hansing Honored by Engineering Society

Dr. Frank Hansing

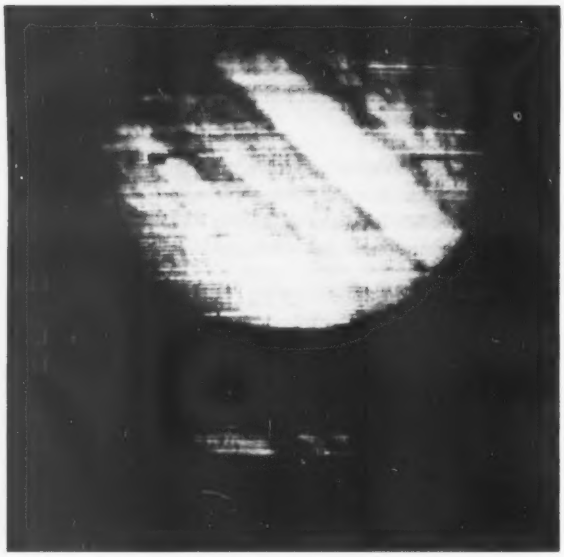
Dr. Frank D. Hansing, Director of the NASA Office of University Affairs, recently was presented a Distinguished Service Citation by the American Society for Engineering Education (ASEE) at its annual assembly at Colorado State University at Fort Collins.

This was the first such award to be presented by ASEE and was given in recognition to a non-engineer for his unique contribution to engineering education.

The citation referred to Dr. Hansing as "an accomplished administrator of federal programs that have contributed significantly to the ability of the engineering education community to meet the manpower challenges of the space age."

He was cited specifically for, among other things, "his skillful handling of the NASA University Affairs Program" and for "his adroitness in interpreting to the public the crucial dependence of the NASA mission on the availability of well-trained and highly-motivated engineers and engineering technologists."

A graduate of the University of Illinois in Agricultural Economics, Dr. Hansing joined NASA's Office of University Affairs in 1962 as Director of the Training Division. In 1967, he was made Director of the Sustaining University Program Division and, in 1971, was named to his present position.



Before . . . . *This is a photograph of Jupiter taken by the Pioneer space craft and received on Earth in the form of raw data and in rough form.*

. . . And After *This Pioneer photograph of Jupiter, showing the Great Red Spot, is much improved after the image is rectified by computers and interpolated to reduce distortion and increase sharpness.*

Photographing the Solar System from Space

Editor's Note: The following is excerpted from an article written by Nicholas Panagakos, NASA Public Affairs Officer for Space Science, for Collier's Year Book of Science. It is reprinted with the permission of the publishers, MacMillan Corp., New York.

To those involved in the unmanned exploration of the planets, one of the most oft-heard comments has to do with the striking closeup pictures of Jupiter, Venus and Mercury taken recently by NASA spacecraft.

People ask: How can thousands of pictures be sent across tens of millions of miles, from one world to another?

Considering the small size of these space robots—and the distances involved—sending information back to Earth seems next to impossible.

To photograph cloud-shrouded Venus and tiny Mercury close up, Mariner 10, hardly more than a fragile mechanical insect with electronic eyes, skittered through 135 million miles of space.

And the 560-pound Pioneer 10 spacecraft to Jupiter navigated a void of 500 million miles and took 21 months to get there.

The time element alone is enough to seem to practically guarantee a breakdown in equipment. But spacecraft such as Pioneer also have to cross a rocky, previously unexplored asteroid belt, and plunge into intense radiation belts, a strong magnetic field, high gravitational pull and dust belts. Solar radiation heats metal to hundreds of degrees. At the same time, anything not exposed to the radiation is unbelievably cold.

Through all this, an interplanetary craft must do more than hang on. It must continually check itself, adjusting its balance by firing tiny jets, making sure its sensors point to certain stars for navigational reference, and then locking onto an Earth antenna millions of miles away so that it can relay its information to scientists. And this is long before a spacecraft gets close enough to a planet to begin its photographic mission.

How do they do it?

The most surprising thing to many people is to learn that the pictures of the planets seen on television and in the newspapers are really computer reproductions of digital data, originally measured in 64 intensities of light. Because of its limited power supply, a spacecraft cannot transmit a picture across distances of millions of miles. It does the next best thing, which is to *translate* the picture, sending what is really the *equivalent* of the picture being snapped by the cameras moving past the planet.

Each picture made by Pioneer, for example, is itself made up of 200 lines. Each line is made up of dots—200 dots to a line, for a total of 40,000 dots per picture. Scientists call these dots elements.

The elements are broken down into still smaller units called bits. There are six bits per element, for a grand total

of 240,000 bits of binary code for a single picture.

Each bit is a complete unit of information that will be recognize as such by the powerful antennas and computers waiting to receive them on Earth.

But up to this point the information is still in analogue form; it must be put into digital language. It's done this way: an electron beam within the spacecraft scans a photograph in analogue. This gives it an electrical analogy of the light intensities detected by the camera. The electron beam reacts to the intensity of light from each dot, converting it into a numerical code that runs from one to six. Each individual dot of any picture can be any one of 64 shades of gray, beginning with white and going all the way to black.

After each dot is converted to its code of any one of six numbers, the numbers are sent back to Earth, recorded and run through a computer. The computer notes the numerical code of each dot and prints pictures made up of dots of varying grayness based on that numerical code.

On the Mariner 10 mission to Venus and Mercury, scientists employed two television cameras similar to those flown on the Mariner Mars 1971 missions but fitted with more powerful 1,500-mm Cassegrain telescopes. These produced pictures of Mercury with a resolution similar to that of pictures of the Moon taken through Earth-based telescopes. Previously, only gross shading characteristics could be distinguished on Mercury with Earth telescopes. With the cameras pointed in the nadir direction (looking vertically downward at the surface) and the spacecraft at an altitude of 500 miles, the wide and narrow angle cameras can detect objects as small as 500 yards and 150 yards, respectively.

Some 5,700 frames were taken at Venus, and 2,740 frames at Mercury. At Mercury encounter, each camera produced a picture every 42 seconds.

The two vidicon cameras were equipped with eight filters each, and were mounted on a scan platform allowing movement in vertical and horizontal directions for precise targeting. Cassegrain telescopes were attached to the vidicon cameras for narrow angle photography. An auxiliary optical system mounted on each camera provides wide angle photography. Exposure times ranged from three million seconds to 12 seconds. Each television picture consisted of 700 scan lines. There were 832 picture elements per line. Picture elements were digitally coded into eight bit words for transmission. The narrow angle system had a focal length of 1,500 mm and one-half degree field of view; the wide angle, 62 mm and 11-by-14 degree field of view.

Scientists used a somewhat different technique to obtain the magnificent pictures of giant Jupiter and its Great Red Spot. The instrument was an imaging photopolarimeter, which uses a photoelectric sensor to measure changes in light intensity, much like the light sensor of a TV camera. But unlike a TV camera, the IPP used the five-revolution-per-minute spin of the spacecraft to scan the planet electronically in narrow strips during a part of each revolution. The spin-scan image consisted of picture elements, each representing a 40-mile square of surface, measured as one of 64 light intensities.

Aimed according to preset ground commands, the telescope measured Jupiter's light intensity every 1/1000th of a second in red and blue. Intensities were then stored in a spacecraft memory holding up to 508 picture elements per roll. These were sent toward Earth at the rate of 1,024 bits/sec. of information. In all, about 50 billion bits were returned. About half represented picture elements and the other half covered other instruments and the spacecraft.

Through superimposition of the red and blue elements, two-color images were reconstructed following transmission of the number-coded intensities to Earth. It took from 25 to 110 minutes to complete a picture.

Overall, Pioneer 10 yielded 336 images of Jupiter and 10 of its four moons.

Back on Earth, 210-foot antennas await the signal from the spacecraft. However, by the time it gets to Earth, the signal has been reduced to an infinitesmal fraction of a watt. Pioneer 10's eight-watt signal, for example, transmitted from Jupiter, reached antennas with a power of only 1/100,000,000,000,000,000 watts. Collected for 19 million years, this energy would light an ordinary Christmas tree bulb for only one-thousandth of a second! To get around this, signals are piped through liquid helium in the form of a cryogenic maser. This boosts them to a signal strength a thousand times greater than when they reached the antenna.

At many times during a mission, the spacecraft acquires data faster than the data can be transmitted to Earth. When that happens, a data storage subsystem stores the information on a digital tape recorder until it can be transmitted to Earth at a slower rate later.

Computer techniques are required to compensate for smear caused by spacecraft rotation, the planet's shape and its rates of rotation (at different latitudes), and the spacecraft trajectory at continuously changing speeds during approach and flyby. Even then, the picture received by scientists on Earth still leaves a lot to be desired. Once more, in a complex, time-consuming process, the computer is used to enhance the images by altering the contrast and adding cosmetics, and by filling in gaps where some data bits are lost between camera measurement and receipt on Earth.

The end result is a fascinating picture, such as that seen on these pages. Through the miracle of space photography, the mysterious veils of distance and inaccessibility are lifted. Man for the first time gets a closeup glimpse of Mercury's scorched surface, a you-are-there view of Jupiter's mysterious Great Red Spot, an astonishing look at the jumbled terrain and deep crevasses on Mars, and, perhaps soon, a dazzling picture of giant Saturn's multi-colored rings.

ATS-6 in Position for Indian Experiment

Moved a third of the way around the globe beginning the week of May 20, the Applications Technology Satellite (ATS-6), the world's largest and most powerful communications spacecraft, reached its new position on June 27 and is now ready to participate in a year-long instructional television experiment over India.

After a checkout, it will begin in mid-July to track the Apollo and Soyuz spacecraft taking part in the Apollo Soyuz Test Project, thus becoming the first satellite to be used to relay television from a manned spacecraft to the Earth's surface.

On August 1, it will begin the Satellite Instructional Television Experiment (SITE), a joint effort by NASA and the Indian Space Research Organization (ISRO). In this, it will relay daily TV programs produced by the Indians to 5,000 villages and cities in seven states throughout India.

SITE will come after a year of operation in which ATS-6, stationed over the Western Hemisphere, was used along with ATS-1 and ATS-3, simpler communications satellites providing two-way voice transmissions, for a variety of technological and scientific experiments. The most extensive of these was the Health-Education Telecommunications (HET) experiment conducted under the auspices of the U.S. Department of Health, Education and Welfare.

HET's objective was to determine if a satellite can be used effectively to transmit education and medical material by television to and from isolated communities equipped with small, inexpensive antennas for direct reception. Isolated communities of Appalachia, the Rocky Mountain region, and Alaska participated.

The initial educational programming transmitted over ATS-6 was the Appalachian Educational Satellite Project, a part of HET. Developed by the Appalachian Regional Commission under an HEW grant, this project began July 2, 1974, with the first educational courses for credit ever taught via space satellite TV. Developed by the University of Kentucky, these summer school courses were aimed at career development for graduate-level elementary school teachers.

During the 1974-75 school year, junior and senior high school teachers in the Appalachian area received in-service training career education via ATS-6, including live seminars on topics of current interest.

Also during the fall of 1974, the Federation of Rocky Mountain States began its Satellite Technology Demonstration as part of HET. This experiment focused on junior high school students as its primary audience. About 5,000 students in 56 rural communities throughout Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, Montana, and Wyoming received programs in career education directly by ATS-6. The programming was transmitted to the satellite from Denver. As many as 20,000 other students received the programming through the region's public television stations.

The Alaskans' need for more and better communications was met partly through use of ATS-6 in still another HET experiment, the Alaska ATS-6 Educational Telecommunications Experiment. Several series of programs were broadcast via ATS-6 to 18 communities whose members are Caucasians, Indians and Eskimos. Most of these communities had no previous television service at all.

Conducted under the auspices of the Office of Telecommunications of the Office of the Governor of Alaska, this experiment consisted of instructional programming and public broadcasting. Instructional programming included basic oral language development, health education, early childhood education, and in-service teacher training.

Public broadcasting included a program series called the Alaska Native Magazine, featuring such subjects of native concern as land claims, pipeline impact, and native culture and arts. The programs had built-in pauses for viewers to express opinions and ask questions over a two-way satellite voice hookup. The programs also were followed by bilingual panel discussions.

Additional facets of the Alaska Native Magazine included radio programs broadcast to Alaska at the same time they were broadcast in the contiguous 48 states. Without the ATS-6 broadcasts, Alaskans receive live broadcasts only of major events, and television network evening news programs are delayed from four to 30 hours after they are broadcast in the contiguous states.

Telemedicine, another portion of the HET Alaska experiment, was conducted to evaluate the use of video and voice information in medical consultation and diagnosis by satellite. Both health aides and physicians involved say that regular, daily consultations through ATS-6 have improved the quality of health care and that, in fact, the satellite is responsible for saving the lives of several people during emergency situations.

The Veterans Administration and the University of Washington Health Sciences Administration also used ATS-6 to conduct medical education experiments in Appalachia and the Pacific Northwest as part of the HET experiment.

During April, ATS-6 was used to track NASA's GEOS-3 geodetic satellite in Earth orbit and relay data to and from it. The first such experiment ever conducted, this proved to be a major step toward the day when satellites will be used in place of ground stations for tracking and communications control of other satellites as part of an operational worldwide tracking network.

Since September of last year, ATS-6 has also been used in a series of experiments to demonstrate and evaluate the use of a geosynchronous orbit satellite for aeronautical and maritime communications and traffic control. An international experiment, this was conducted by NASA in conjunction with the U.S. Departments of Commerce and Transportation, along with the European Space Research Organization and the Canadian Department of

Communications and Ministry of Transport.

Called the "L-Band Experiment" for the frequencies allocated to the aeronautical and maritime mobile-satellite communications, it produced several firsts. These include:

- First aircraft-to-ship communications relay via satellite;
- First direct flight control of an aircraft by an ocean air traffic controller using a satellite; and
- First search-and rescue operation (simulated) directed by means of a satellite.

One of several technological experiments with ATS-6 permits remote attitude control of the spacecraft by commands sent from a ground station directly to the attitude and orbit control thrusters. The success of this experiment thus far indicates that it may be possible to launch future geostationary spacecraft without expensive, complex, and redundant onboard attitude and orbit control systems. If found to be operationally feasible, this could substantially reduce the relative cost of future missions. No experiment like this had ever before been done.

Other technological experiments conducted with ATS-6 during its first year of operation were aimed at improving future spacecraft and terrestrial communications. Tests were conducted to evaluate millimeter-wave frequencies. Others were performed to investigate the mutual radio frequency interference in the six gigahertz common carrier frequency band shared between spacecraft and terrestrial telecommunications systems.

ATS-6 is the sixth in a series of Applications Technology Satellites designed to test in space new concepts having a direct bearing on man's activities on Earth. The ATS program is directed by NASA's Office of Applications. Project management is under the Goddard Space Flight Center. Fairchild Industries, Germantown, MD, was the prime contractor for development, integration, and test of ATS-6. Hughes Aircraft Co., El Segundo, CA, was prime contractor for the first five ATS spacecraft.

Laboratory for Spacelab Simulation—*Here are exterior and interior views of Ames Research Center's Galileo II, the airborne laboratory in which five U.S. and European scientists recently completed a Spacelab simulation mission.*

Spacelab Simulation Mission Completed

Both U.S. and European Scientists Conduct Experiments in ARC's Airborne Laboratory

The Airborne Science Office at Ames Research Center recently completed an extensive simulation of a Shuttle Spacelab mission, using the CV 990 Galileo II.

This project, called ASSESS (Airborne Science/Spacelab Experiments System Simultation) was designed to carry out actual scientific research aboard the airborne laboratory, with the entire operation being constrained to represent actual Spacelab operation.

The mission was a joint NASA-European Space Agency (ESA) endeavor, with Principal Investigators from Meudon Observatory near Paris; Gonigen University, The Netherlands; Queen Mary College, London; University of Southhampton in England; University of Alaska; Jet Propulsion Laboratory; University of New Mexico; University of Colorado; National Oceanic and Atmospheric Administration (NOAA), Boulder, CO, and Ames Research Center.

Two U.S. and two European scientists, along with Louis Haughney, the Ames Mission Manager, spent six days confined to the aircraft and living quarters trailer. They operated all of the experiments in behalf of the Principal Investigators located in the ground-based Mission Operations Center.

The four scientists confined aboard the aircraft with Haughney were Dr. John E. Beckman of Queen Mary College in London; Nicholas Wells, a graduate student at the University of Sussex in England; Dr. Robert A. Parker, NASA astronaut from Johnson Space Center, and Dr. Kenneth A. Dick of the University of Maryland. They

conducted seven experiments chosen for ASSESS to approximate the type of research to be undertaken in the 1980s on a Spacelab mission lasting from seven to 30 days.

A series of five constrained flights to represent Spacelab operation began June 2 and were completed June 7. An additional seven flights with the crew unconstrained were conducted between June 11 and June 20. All flights were made over the Western U.S. The CV 990 flew over portions of Washington, Idaho and as far east as Oklahoma and Texas on flights lasting about six hours.

Experiments included infrared mapping of celestial dark clouds and hydrogen regions, infrared observations of Venus and late-type stars, ultraviolet measurements of planetary atmospheres, infrared photography of night glow clouds, and measurements of infrared emissions from the Earth's outer atmosphere.

Objectives of the simulation, in addition to obtaining the basic scientific information, were to study the entire management and implementation concept for carrying out multiple experiments in Spacelab in the most efficient and cost-effective manner. Evaluation is being made of the management and mission operation, optimum design approaches for Spacelab experiments, interactions between experiment operators in Spacelab and Principal Investigators on the ground, training requirements for Spacelab participants to carry out proxy experiment operations, experiment difficulties and correction approaches during real-time operation, spare parts and tools requirements, and many other elements which will be important to successful Spacelab operations. The project does not address or evaluate the physiological or psychological factors.

The project was officially planned and guided by representatives from ESA Headquarters in Paris; ESTEC in Noordwijk, The Netherlands; NASA Headquarters, Marshall Space Flight Center, Johnson Space Center and Ames Research Center.

In addition to an extensive general debriefing of the entire mission, individual interviews with each of the key participants revealed genuine satisfaction with the results. Dr. Johannes DeWaard, ESA Project Representative from Paris, summed up the feeling of the participants during the debriefing as follows:

"We think this was a very successful operation which has brought many nations closer together again, despite the handicap of five languages. I hope that, if we continue what we have started with the ASSESS program, we will have Spacelab missions in which all nations will participate."

Shuttle Launch System Contract Awarded

The Kennedy Space Center has awarded a contract totaling $6,473,074 for minicomputer and associated equipment and services for the Space Shuttle program to Modular Computer Systems, Inc., of Fort Lauderdale, FL.

The award, a fixed-price and indefinite-quantity contract, includes $4,226,646 in hardware and services already ordered and another $2,246,428 for additional hardware which may be needed.

Under the terms of the contract, Modular Computer Systems, Inc., which is classified as a small business firm, will supply minicomputers, peripheral equipment, special interface devices, associated software, engineering and maintenance support, spares, documentation and training to KSC's Design Engineering Directorate. The equipment and services will be used in connection with the Checkout, Control and Monitor Subsystem, which is a part of the Launch Processing System to be used for Space Shuttle launch activities.

Rediess Named FRC Research Director

Dr. Herman A. Rediess, who spent his summers working as an engineering technician at the Flight Research Center while attending the University of California at Berkeley, has been named Director of Research at FRC.

In his new role, he will be responsible for the planning and direction of all disciplinary aeronautical research activities at the Center.

After his graduation in 1959, Dr. Rediess joined NASA as an aeronautical engineer. He received his M.S. degree from the University of Southern California in 1964 and his Ph.D. in Aeronautical and Astronautical Engineering from the Massachusetts Institute of Technology in 1969. Formerly Deputy Director of Vehicle Dynamics and Control at FRC, he has specialized in stability and control research.

MSFC Asks Quotations on Solar Array

A request for quotations has been released to business and industry by the Marshall Space Flight Center for the design, fabrication, testing and delivery of a full-scale solar array wing for solar electric propulsion and Space Shuttle payload applications.

Several technology studies have been accomplished in recent years which have defined concepts of lightweight solar arrays that could be used to provide electric propulsion for upper stage, ferry-type vehicles in the Space Transportation System.

The proposed study would bring together all technology developed from these previous studies to establish design requirements for a solar array wing.

Technology development during performance of the contract is expected to reduce greatly the cost per watt of power, reduce the weight and cost of the structure, and increase substantially the lifetime of solar electric propulsion systems.

A night, a day, and an army, 1775.

The night, April 18, 1775. Paul Revere, the Boston silversmith, makes his legendary ride to Lexington to warn the citizenry that *"The Redcoats are coming!"*
The day, April 19, 1775. A small group of Minutemen gather at the Lexington Common to intercept a superior British force on its way to Concord. Seven Minutemen fall, the first American casualties of "the shot heard round the world."
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Radio-Television

(Released Nationally)

Television—A color film release in the *Aeronautics and Space Report* monthly series: "Viking," featuring Jim Martin and Gerald Soffen from LaRC and Carl Sagan from Cornell University.

Radio—Five weekly *Space Story* programs have been released: "Apollo Soyuz": Astronaut Vance Brand"; "Apollo Soyuz: Astronaut Tom Stafford"; "Apollo Soyuz EUV Experiments," (U. of Cal./Dr. Bowyer); "Florida Resource Observations," (KSC/Claybourne); and "Space Shuttle—The Next Step," (JSC-Kraft). One monthly *NASA Special Report*, "Viking," (featuring Gerald Soffen from LaRC).

Lunar Sample Exhibits

The following is a schedule of lunar sample exhibits form July 15 to August 15, 1975:

California—Orange County Fair, Costa Mesa, July 11-20.

Illinois—American Feedom Train, Peoria, July 15; Chicago, July 24.

Missouri—Heart of the Ozarks Fair, West Plains, July 23-26.

North Carolina—Tenth Annual Macon County Gemboree, Franklin, July 24-27.

Ohio—Armstrong Air & Space Museum, Wapakoneta, July 15-Sept. 4.

Pennsylvania—Quasquicentennial Celebration, Punxsutawney, August 1-9.

Virginia—Danville Museum of Fine Arts and History, July 4-18.

Texas—Houston Museum of Natural Science/History, End of Caroline at Hermann Park, Houston, July 15-August 15.

Long Term Displays

Alabama—Alabama Space and Rocket Center, Marshall Space Flight Center, Huntsville.

Florida—Visitor Information Center, Kennedy Space Center.

Kansas—Eisenhower Library, 200 SE 4th Street, Abilene.

New York—United Nations Building, New York City.

Ohio—U.S.A.F. Museum, Wright Patterson AFB.

Texas—Johnson Library, University of Texas, Austin; Visitor Information Center, Johnson Space Center, Houston.

Virginia—Visitor Information Center, Langley Research Center, Hampton.

Washington, DC—National Geographic Museum; Smithsonian Institution, National Air and Space Museum, 1000 Jefferson Drive; Washington National Cathedral.

Headquarters Press Releases

(Issued by the Public Information Division, Code FP, Headquarters, Washington, DC 20546. These releases are available only to members of the news media.)

75–121 Note to Editors: Correction of Typographical Error in 75–101
75–122 Satellite Tracked by Another Satellite
75–123 Test Firings to Resume in Mississippi
75–124 Study of Freon Threat Underway at NASA
75–125 Intelsat IV Press Kit
75–126 NASA and ESRO to conduct Spacelab Simulation
75–127 Proposals Sought for 1979 Uranus Mission
75–128 Space Shuttle Wings Take First Trip
75–129 American-Peruvian Rocket Launchings
75–130 Satellite Searching Stars for Signals
75–131 Note to Editors: Correction to Telesat-C Press Kit
75–132 Minority Businessmen Attend NASA Space Benefits Program
75–133 Newly Developed Solar Cell Promises High Radiation Resistance
75–134 U.S. Will Launch Indonesian Satellite
75–134 Canada to Build Shuttle Remote Manipulator
75–136 Studies Probe Aircraft Wakes
75–137 Note to Editors: Press Conference Scheduled with ASTP Apollo Crew May 14
75–138 Note to Editors: ASTP Audio Service
75–139 Space Pictures Help States Plan Flood Relief
75–140 Life Science Program in the 1980s Being Planned
75–141 Moscow/Houston Control Centers to Hold Joint ASTP Simulation
75–142 Walter T. Bonney Obituary
75–143 Apollo Soyuz Working Groups Hold Final Session in Russia
75–144 Kennedy Space Center to Issue ASTP, Viking Cachets
75–145 Nimbus-F Press Kit
75–146 Space Mission Outside Ecliptic Plane Symposium Topic
75–147 NASA Selects Deputy for EO Programs Office
75–149 Flying Observatory Will Be Named for Kuiper
75–150 NASA-Developed Ion Engine May Permit Larger Spacecraft Payloads
75–151 NASA Marks 100th Successful Delta Launch
75–152 Five Men Will Set Space "Population" Record
75–153 Advanced Communications Satellite Begins Move to Support Experiment in India
75–154 Harold Stall Named JSC Public Affairs Officer
75–155 Final Apollo Crew Press Conference and ASTP Briefing June 6
75–156 US, USSR Sign ASTP Flight Readiness Review
75–157 Viking News Conference Set for June 12
75–158 OSO-I Press Kit
75–159 Earth-Pacing Satellite Moves for Good View of India
75–160 Minority Owned Business to Produce Water-Driven Machine
75–161 Weinberger, Von Braun to Address Earth Resources Symposium
75–162 Ultrasound Medical Diagnosis System Developed
75–163 NASA Information Facility to Be Dedicated
75–164 Scientists Will Discuss Cities in Space
75–165 Quieter, Cleaner Light Airplanes Sought in Lewis Center Study
75–166 Apollo Soyuz Experiment Seeks Improved Magnetic Materials
75–167 Apollo Soyuz Experiment Seeks Improved Optical Fibers
75–168 World MHD Specialists to Meet at Lewis Center
75–169 Light from the Atom—Milestone Toward New Energy
75–170 Radar Probes Jovian Moon Ganymede for First Time
75–171 Is Moon an Ancient Piece of Earth?
75–172 Neil Hosenball Named NASA General Counsel
75–174 Space-Air-Sea Mission to Assess Marine Features
75–175 Industry Invited to Solar Energy Briefings
75–176 Relay Satellites System Companies Named
75–177 Spacelab Simulation Mission Completed
75–178 ASTP Experiment May Resolve the Value of Electrophoresis in Space
75–179 Bruce Murray Appointed New JPL Director
75–180 Solar Energy Briefings Rescheduled
75–181 Mars Lander Successfully Completes Sterilization
75–182 ERDA, NASA Sign Agreement on Energy R&D

Patents for Inventions Resulting from NASA Research

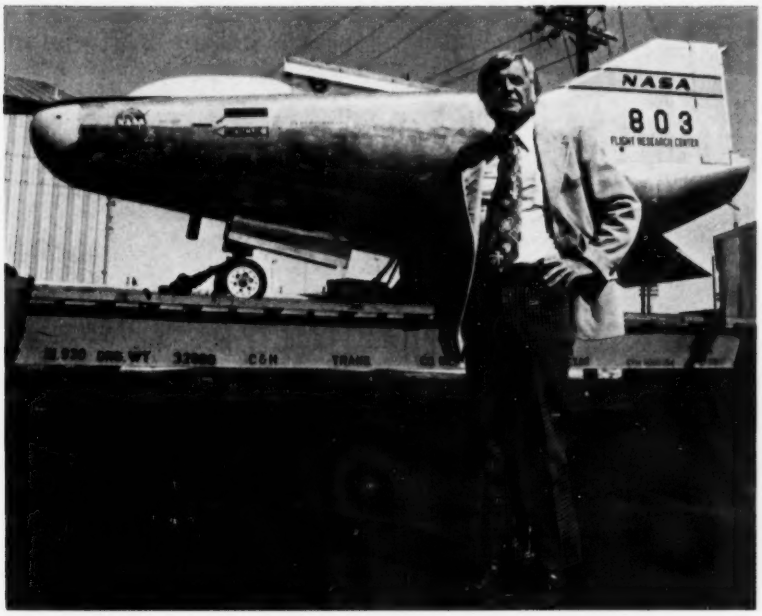
The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel for the indicated installation.

Inventor(s) and Employer	Title and NASA Docket	Patent No.	Installation
Glenn E. Pollock, Milton E. Henderson and Ralph W. Donaldson, Jr., NASA/ARC	Gas Chromatograph Injection System (ARC-10,344-2)	3,887,345	ARC
Joseph M. Sherfey, NASA/GSFC	Process for Making Sheets with Parallel Pores of Uniform Size (GSC-10,984-1)	3,887,365	GSFC
Charles W. McKee, NASA/LaRC	Fluid Control Apparatus and Method (LAR-11,110-1)	3,888,410	LaRC
Ramesh C. Tyagi, National Research Council, Washington, DC and William J. Debnam, Jr. Maxwell F. McNear, Roger K. Crouch and Roger A. Breckenridge, all of NASA/LaRC	Vapor Phase Growth of Groups III-V Compounds by Hydrogen Chloride Transport of the Elements (LAR-11, 144-1)	3,888,705	LaRC
Robert L. Kurtz, NASA/MSFC	Real Time, Large Volume Moving Scene Holographic Camera System (MFS-22,537-1)	3,888,561	MSFC
Thomas A. Telfer, General Electric Co., Utica, NY	Method of Determining Bond Quality of Power Transistors Attached to Substrates (MFS-21,931-1)	3,889,122	MSFC
Edwin E. Klingman, III, NASA/MSFC	Apparatus for Calibrating an Image Dissector Tube (MFS-22,208-1)	3,889,155	MSFC
Wesley C. Easley, William F. White and George A. Wingfield, NASA/LaRC	Resonant Wageguide Stark Cell (LAR-11,352-1)	3,889,182	LaRC
Alan R. Johnston, Caltech/JPL, Pasadena, CA	Cooperative Multiaxis Sensor for Teleoperation of Article Manipulating Apparatus (NPO-13,386-1)	3,888,362	NaPO
Tage O. Anderson, Caltech/JPL	A Synchronous, Multiplexing, Single Line Transmission and Recovery Data System (NPO-13,321-1)	3,889,064	NaPO
George R. Hansen, Jr., Caltech/JPL	Vehicle Locating System Utilizing AM Broadcasting Station Carriers (NPO-13,217-1)	3,889,264	NaPO
David F. Putnam and Richard L. Vaughn, McDonnell Douglas Corp., Santa Monica, CA	Electrolytic Cell Structure	3,891,533	LaRC
Robert T. Menzies, Caltech/JPL	Fluorescence Detector for Monitoring Atmospheric Pollutants (NPO-13,231-1)	3,891,848	NaPO
Stacy R. Hunt, Jr., General Electric Co., Philadelphia, PA	Multiparameter Vision Testing Apparatus (MSC-13,601-2)	3,891,311	JSC
Herman Levin, Byron H. Auker and Michael N. Gardos, Hughes Aircraft Co., Culver City, CA	Refractory Porcelain Enamel Passive Control Coating for High Temperature Alloys (MFS-22,324-1)	3,891,452	MSFC
Albert P. Garavaglia and Dennis S. Matsuhiro, NASA/ARC	Shoulder Harness and Lap Belt Restraint System (ARC-10,519-2)	3,887,233	ARC
Ronald J. Wojtasinski, James H. Jones and Raymond V. Lisle, NASA/KSC	Lightning Current Measuring Systems (KSC-10,807-1)	3,889,185	KSC

Projected Launch Schedule

(As of June 20, 1975)

Name	Launch Date	Vehicle	Range	Mission Remarks
ASTP	July 15	Saturn 1B	ETR	The U.S. launch for the U.S.-Soviet manned space flight. American astronauts in an Apollo Spacecraft will rendezvous and dock with Soviet cosmonauts in an orbiting Russian Soyuz spacecraft to test a new universal docking system and to condbct joint and unilateral experiments.
ESRO-COS-B	Aug. 7	Delta	WTR	European scientific satellite to study extraterrestrial gamma radiation. Reimbursable.
Viking-A	Aug. 11	TIII-Centaur	ETR	Planetary mission to explore Mars from orbit around the planet with a capsule on its surface.
Viking-B	Aug. 21	TIII-Centaur	ETR	Planetary mission to explore Mars from orbit around the planet with a capsule on its surface.
Symphonie-B	Aug. 27	Delta	ETR	Second joint French/German experimental communications satellite designed for TV, telephone, and data transmission. Reimbursable.
Intelsat IVA-A	Sept.	A-Centaur	ETR	First of a series of improved Intelsat satellites that will have almost double the capacity of the present Intelsat IV satellites. Reimbursable.
Marisat-A	Sept.	Delta	ETR	Comsat Corp, satellite to provide maritime satellite communications service. Reimbursable.
Atmosphere-D	Sept	Delta	WTR	A scientific satellite to investigate the chemical processes and energy transfer mechanisms which control Earth's atmosphere.
Atmosphere-E	Sept.	Delta	ETR	A scientific satellite to investigate the chemical processes and energy transfer mechanisms which control Earth's atmosphere.
Marisat-B	3rd. Qtr.	Delta	ETR	Second Comsat Corp. satellite to provide maritime satellite communcations services. Reimbursable.
SMS-C/GOES-A	Oct.	Delta	ETR	First operational synchronous meteorological satellite of the National Weather Service of the Department of Commerce to provide continuous day and night global cloud-cover observations. Reimbursable.
Dual Air Density	Nov.	Scout	WTR	Two scientific spacecraft will be placed in orbit to obtain simultaneously measurements of the composition of upper and lower levels of the atmosphere.
ITOS-E2	Nov.	Delta	WTR	Operational meteorological satellite of the National Weather Service to provide day and night cloud cover imagery. Reimbursable.
RCA-A	4th Qtr	Delta	ETR	First of a series of domestic communications satellites for RCA. Reimbursable.
Intelsat IVA-B	4th Qtr.	A-Centaur	ETR	Second of a series of improved Intelsat satellites. Reimbursable.
CAS-C/CTS	4th Qtr	Delta	ETR	Canadian-U.S. cooperative experimental communications satellite to develop and test the technology of high-power satellite television communications systems.
1976				
HELIOS-B	Jan.	TIII-Centaur	ETR	Second West German/NASA cooperative satellite to investigate the properties of the processes in interplanetary space close to the Sun.
Comstar-A	1st Qtr.	A-Centaur	ETR	Domestic communications satellite for Comsat Corp. Reimbursable.
Relativity (Gravity Probe)	1st Qtr.	Scout	WI	Scientific satellite to make a test of Einstein's Theory of Relativity.
RCA-B	1st. Qtr.	Delta	ETR	Second domestic communications satellite for RCA. Reimbursable.
NATO-C	1st Qtr.	Delta	ETR	Communications satellite in synchronous orbit to perform communications relay for NATO. Reimbursable.



On the Way to the Smithsonian–This rocket-powered M-2 lifting body, the first of the heavyweight wingless craft to pave the way for the Space Shuttle, is about to be trucked from Flight Research Center to the Smithsonian Institution in Washington, where it will be displayed in the new Air and Space Museum. Standing beside it is Milt Thompson, Chief Engineer for FRC, who piloted the first M-2 flight on July 12, 1966.

Name	Launch Date	Vehicle	Range	Mission Remarks
LAGEOS	1st Qtr.	Delta	WTR	Laser-reflecting satellite to demonstrate relevant space techniques that will contribute to the development and validation of predictive models for earthquake hazard alleviation, ocean-surface conditions and ocean circulation.
Intelsat IVA-C	1st Qtr.	A-Centaur	ETR	Third of a series of improved Intelsat satellites. Reimbursable.
Westar-C	April	Delta	ETR	Backup domestic communications spacecraft for Western Union. Reimbursable.
Comstar-B	2nd Qtr.	A-Centaur	ETR	Second domestic communications satellite for Comsat. Reimbursable.
ESRO-GEOS	2nd Qtr.	Delta	ETR	ESRO spacecraft to support space applications geoscience experiments in ocean topography measurements and solid Earth physics. Reimbursable.
Marisat-C	2nd Qtr.	Delta	ETR	Comsat Corp. satellite to provide maritime satellite communications services. Reimbursable.

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For a penny of your tax dollar,
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A New, Improved Firefighter's Breathing System

For years, NASA has worked to apply space technology to equipment which will make it easier and safer for firemen to battle the fire hazard throughout the nation that annually results in thousands of deaths and an estimated billions of dollars in property loss.

The space agency's first development was fire-protective clothing that enabled firefighters to move closer to a blaze and even enter it if necessary. More recently, engineers at the Johnson Space Center at Houston, TX, have developed a prototype breathing system expected to go into widespread use.

Known as the FBS, the system is about 30 percent lighter than conventional systems. It features an improved face mask, which permits better vision, and a unique high pressure, longer duration air tank made of spiral wound glass fiber over an aluminum liner, a technique originally used for lightweight, self-propellant rocket motor cases.

Although conventional breathing systems are considered acceptable, they are cumbersome to wear and restrict vision. The new system is designed to give the firefighter greater safety and efficiency.

The FBS is now undergoing field evaluation conducted jointly by NASA and the fire departments of New York City, Houston and Los Angeles. It is expected to be made available commercially to firefighters throughout the country later this year.

The photo at top shows a JSC fireman outfitted with the new equipment. The picture at the bottom was made at a recent ceremony in Washington at which Howard McClennan (right), President of the International Association of Fire Fighters, presented the Association's Award for Distinguished Achievement to Pat B. McLaughlin, former Project Manager for the FBS, shown with his wife.

NASA

National Aeronautics and
Space Administration

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